PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : F16B 19/14 — A1

(11) International Publication Number: WO 90/15261

(43) International Publication Date: 13 December 1990 (13.12.90)

(21) International Application Number: PCT/AU90/00229

(22) International Filing Date: 30 May 1990 (30.05.90)

(30) Priority data:
PJ 4463 30 May 1989 (30.05.89) AU

(71) Applicant *(for all designated States except US)*: RAMSET FASTENERS (AUST.) PTY. LIMITED [AU/AU]; Maroondah Highway, Croydon North, VIC 3136 (AU).

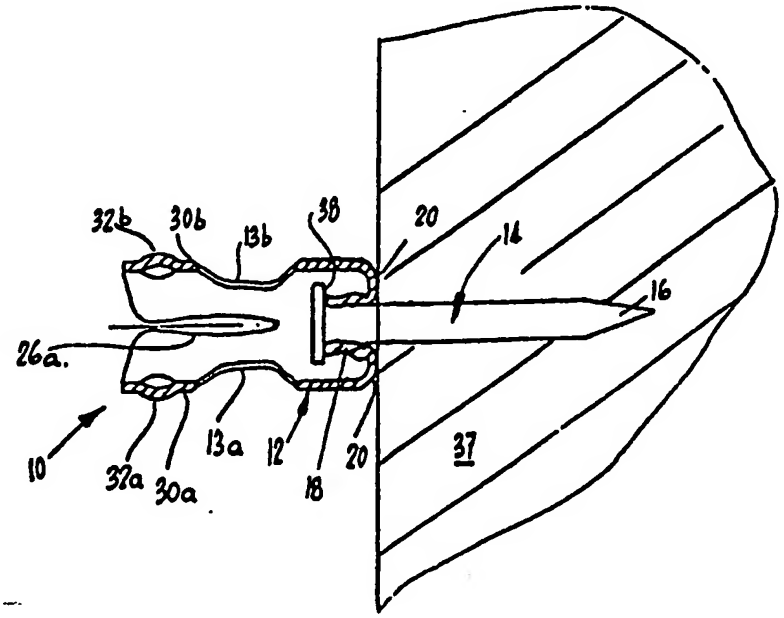
(72) Inventor; and
(75) Inventor/Applicant *(for US only)* : LOGAN, Alan [AU/AU]; 8 Bellavista Place, North Ringwood, VIC 3134 (AU).

(74) Agents: HIND, Raymond et al.; Davies & Collison, 1 Little Collins Street, Melbourne, VIC 3000 (AU).

(81) Designated States: AT, AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, BJ (OAPI patent), BR, CA, CF (OAPI patent), CG (OAPI patent), CH, CH (European patent), CM (OAPI patent), DE*, DE (European patent)*, DK, DK (European patent), ES, ES (European patent), FI, FR (European patent), GA (OAPI patent), GB, GB (European patent), HU, IT (European patent), JP, KP, KR, LK, LU, LU (European patent), MC, MG, ML (OAPI patent), MR (OAPI patent), MW, NL, NL (European patent), NO, RO, SD, SE, SE (European patent), SN (OAPI patent), SU, TD (OAPI patent), TG (OAPI patent), US.

Published
With international search report.

(54) Title: A FASTENER ASSEMBLY



(57) Abstract

A fastener assembly comprises a sleeve (12) retained against a substrate by means of a fastener (14) driven into the substrate by a power actuated tool. The sleeve includes an integral internal column (18) projecting rearwardly from the forward end (20) of the sleeve and through which the fastener extends. The column is engaged by the head (38) of the fastener and is progressively collapsed by the head in order to decelerate the fastener.

* See back of page

DESIGNATIONS OF "DE"

Until further notice, any designation of "DE" in any international application whose international filing date is prior to October 3, 1990, shall have effect in the territory of the Federal Republic of Germany with the exception of the territory of the former German Democratic Republic.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	ES	Spain	MC	Monaco
AU	Australia	FI	Finland	MG	Madagascar
BB	Barbados	FR	France	ML	Mali
BE	Belgium	GA	Gabon	MR	Mauritania
BF	Burkina Fasso	GB	United Kingdom	MW	Malawi
BG	Bulgaria	GR	Greece	NL	Netherlands
BJ	Benin	HU	Hungary	NO	Norway
BR	Brazil	IT	Italy	RO	Romania
CA	Canada	JP	Japan	SD	Sudan
CF	Central African Republic	KP	Democratic People's Republic of Korea	SE	Sweden
CG	Congo			SN	Senegal
CH	Switzerland	KR	Republic of Korea	SU	Soviet Union
CM	Cameroon	LI	Liechtenstein	TD	Chad
DE	Germany, Federal Republic of	LK	Sri Lanka	TG	Togo
DK	Denmark	LU	Luxembourg	US	United States of America

"A Fastener Assembly"

The present invention relates to a fastener assembly comprising a sleeve and fastener pin which is adapted to be fastened to a supporting substrate,such as a masonry wall or ceiling, by a power actuated tool and more particularly to such a fastener assembly in which the sleeve is adapted to form an eyelet.

Eyelets may be fastened to concrete wall and ceiling panels or steel or concrete beams to provide anchoring points. One common use is as a means for supporting false ceilings in buildings. Conventional eyelet assemblies for use with power actuated tools (such as explosively actuated tools) comprise a cylindrical eyelet sleeve and a pin-like headed fastener which can be driven into steel or concrete. The fastener is assembled within the sleeve, with the shank of the fastener passing through an aperture in an end wall of the sleeve. A washer around the shank of the fastener and inside the sleeve rests against the end wall of the sleeve and provides the means for decelerating the fastener after firing the tool. Prior to firing, the eyelet assembly is held in the barrel of the power actuated tool by a retainer or aligning tip which fits around the projecting shank of the fastener. When the power actuated tool is fired the eyelet assembly is driven towards the masonry. As the fastener penetrates the masonry, the closed end of the sleeve strikes the masonry and is prevented from further movement. The fastener continues to penetrate the masonry until the underside of the fastener head strikes the washer. The washer collapses under the impact force of the fastener and thereby absorbs much of the kinetic energy of the fastener and which could otherwise destroy the sleeve. It is in this manner that the fastener is decelerated and subsequently comes to rest within the masonry.

This type of eyelet assembly is disadvantageous as four component parts are required, namely the sleeve, the fastener, the washer and the aligning tip. The assembly of these four components is also cumbersome.

According to the present invention, there is provided a fastener assembly for application to a substrate by a power actuated tool, said assembly comprising a sleeve, and a pin-like fastener arranged to pass through the sleeve to anchor secure the sleeve to the substrate by co-operation between a head of the fastener and the sleeve, wherein the sleeve includes means integral with the body of the sleeve to decelerate the fastener within the sleeve when the fastener is fired into the substrate and the head of the fastener approaches its anchoring position.

Further according to the invention, there is provided a fastener assembly for application to a substrate by a power actuated tool, said fastener assembly comprising a sleeve, and a pin-like fastener to be driven into the substrate to anchor the sleeve to the substrate, said fastener having a shank with a head at a rear end of the shank, and said sleeve comprising a body with a forward end arranged to engage the substrate, the shank of the fastener being arranged to pass through the forward end on actuation of the tool to anchor the sleeve to the substrate by means of the head of the fastener which remains within the sleeve, and means integral with the body of the sleeve to decelerate the fastener as the head approaches the forward end of the sleeve.

In a preferred embodiment the means to decelerate the fastener comprises a column integrally formed with the front end of the sleeve, said column projecting axially within the sleeve from the front end of the sleeve. Advantageously, the fastener shank is a friction fit within the column thereby avoiding the need for separate retaining and aligning means.

Still further according to the invention, there is provided a fastener sleeve adapted to be attached to a substrate by a pin-like fastener driven by means of a power actuated tool, said sleeve comprising a tubular body having a forward end wall with an integral tubular column projecting rearwardly within the body, said column being arranged to permit passage of a shank of the fastener through the forward end wall and into the substrate but being engagable by a

head of the fastener in order to decelerate the head by progressive collapse of the column.

An embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:-

Figure 1 is a side view of an eyelet assembly according to the present invention;

Figure 2 is a side view of a sleeve of the eyelet assembly;

Figure 3 is a plan view of the sleeve shown in Figure 2;

Figure 4 is an axial cross-sectional view of the sleeve along line A-A of Figure 3;

Figure 5 is a cross-sectional view of the eyelet assembly as held in the barrel of the power actuated tool prior to firing; and

Figure 6 illustrates the eyelet assembly after firing with the fastener secured within the masonry.

The eyelet assembly 10 shown in Figure 1 comprises a sleeve 12 with diametrically opposed apertures defining eyelets 13a, 13b and a pin-like fastener 14. A pointed end 16 of the fastener shank is held by a friction fit within a hollow column 18 which is integrally formed as part of a forward end 20 of the sleeve 12. The hollow column 18 supports the fastener 14 with the longitudinal axis of the fastener 14 substantially coincident with the axis of the sleeve. The internal diameter of the column 18 is less than the shank diameter of the fastener but large enough to enable the shank of the fastener 14 to be driven through the hollow column 18 when the power actuated tool is fired. The sleeve 12 has diametrically opposed longitudinal slots 26a, 26b which run

from the open rear end 28 of the sleeve 12 to adjacent the forward end 20, and which define circumferential wall segments 30a, 30b.

Figure 5 shows the eyelet assembly 10 positioned within the barrel 22 of a power actuated tool. The tool will usually comprise a piston which is driven forwardly at high velocity upon firing of an explosive charge. To fit the eyelet assembly 10 within the barrel 22 inwardly directed pressure is applied to the circumferential wall of the sleeve 12. Longitudinal slots 26a, 26b allow the circumferential wall segments 30a, 30b to compress together a distance sufficient to fit the eyelet assembly 10 within the barrel 22. The sleeve 12 is sufficiently resilient to ensure spring-back of the wall segments 30a, 30b on release of the inward pressure. Radially projecting dimples 32a, 32b on the outer wall of each wall segment 30a, 30b contact the inner wall 36 of the barrel 22 when the inwardly directed pressure is released from the circumferential wall segments 30a, 30b.

When the power actuated tool is fired, the piston (not shown) of the tool engages the head 38 of the fastener 14 at high velocity and thereby drives the eyelet assembly towards the masonry material 37. Just after the pointed end 16 of the fastener 14 has penetrated the masonry material 37, the closed end 20 of the sleeve 12 impacts the masonry material 37. The sleeve 12 is thereby brought to rest, but the fastener 14 continues to penetrate the masonry material 37 until the underside of the head 38 of the fastener 14 strikes the rear end face 40 of the hollow column 18. The impact force of the head 38 of fastener 14 onto end face 40 causes the column 18 to collapse axially and thus the kinetic energy of the fastener 14 is transformed into energy deforming the column 18. The fastener 14 is thus brought to rest in the masonry material 37 with the head 38 of the fastener engaging the rear end of the collapsed column 18 in order to retain the sleeve against the masonry material. The extent to which the column 18 will collapse and hence the degree of penetration of the fastener will depend on the hardness of the material into which the fastener is

driven, the driving force applied by the tool, and also on the column strength of the column 18.

Figure 6 shows the eyelet assembly 10 after firing with the fastener 14 secured within the masonry material 37. The forward end 20 of the sleeve 12 lies flush with the masonry material 37. Eyelets 13a, 13b, one positioned in each circumferential wall segment 30a, 30b thus provide an anchoring point on the masonry material 37.

The sleeve 12 of the eyelet assembly 10 may be manufactured from a length of metal strip. A hole is punched in the centre of the strip and this is drawn, in a series of drawing operations, upwards to form the hollow column 18. The lower portion of sleeve 12 is then drawn, in a number of stages, in the reverse direction to column 18. This second drawing forms a supporting annulus which supports column 18, and enables the sleeve 12 to retain its tube-like configuration during the deceleration phase. Two holes one either side of the column 18 in the lengthwise direction, are then punched in the strip to form eyelets 13a, 13b. The lengthwise edges of the metal strip are then notched to form circumferential wall segments 30a, 30b. The notches cut in the lengthwise edge are shaped such that subsequent forming operations produce longitudinal slots 26a, 26b. The circumferential wall segments 30a, 30b are then folded upwards about the column 18 to form the tube-like configuration of the sleeve 12. The dimples 32a, 32b are then formed in the wall segments 30a, 30b.

The eyelet assembly 10 described is particularly advantageous as it is a two component system, namely the sleeve and the fastener. The column 18 both supports the fastener 14 when the eyelet assembly 10 is held within the barrel 22 and decelerates the fastener 14 when it is fired into the masonry material 37. This obviates the need for a separate washer and a retainer or

aligning tip is not required to hold the eyelet assembly 10 within the barrel 22 because of the spring effect of the longitudinal slots 26a, 26b and the dimples 32a, 32b.

Although in the embodiment described the sleeve 12 is apertured to form an eyelet sleeve, the sleeve may alternatively be adapted to provide a different type of fastening.

The embodiment has been described by way of example only and modifications are possible within the scope of the invention.

CLAIMS:-

1. A fastener assembly for application to a substrate by a power actuated tool, said assembly comprising a sleeve, and a pin-like fastener arranged to pass through the sleeve to anchor secure the sleeve to the substrate by co-operation between a head of the fastener and the sleeve, wherein the sleeve includes means integral with the body of the sleeve to decelerate the fastener within the sleeve when the fastener is fired into the substrate and the head of the fastener approaches its anchoring position.

2. A fastener assembly for application to a substrate by a power actuated tool, said fastener assembly comprising a sleeve, and a pin-like fastener to be driven into the substrate to anchor the sleeve to the substrate, said fastener having a shank with a head at a rear end of the shank, and said sleeve comprising a body with a forward end arranged to engage the substrate, the shank of the fastener being arranged to pass through the forward end on actuation of the tool to anchor the sleeve to the substrate by means of the head of the fastener which remains within the sleeve, and means integral with the body of the sleeve to decelerate the fastener as the head approaches the forward end of the sleeve.

3. A fastener assembly according to Claim 2, wherein the deceleration means comprises a column within the body of the sleeve and extending rearwardly from the forward end of the sleeve, said column being engagable with the head of the fastener and being collapsible axially to decelerate the fastener.

4. A fastener assembly according to Claim 3, wherein the column is of tubular form and through which the shank of the fastener can extend.

5. A fastener assembly according to Claim 4, wherein in the anchored condition of the assembly the column has axially contracted in order to decelerate the fastener, and the head of the fastener engages the rear end of the column to anchor the sleeve to the substrate.

6. A fastener assembly according to any one of Claims 2 to 4, wherein the fastener is held as a friction fit within the sleeve prior to driving of the fastener into the substrate.

7. A fastener assembly according to Claim 4 or Claim 5, wherein the shank of the fastener is held as a friction fit within the tubular column prior to driving of the fastener into the substrate.

8. A fastener assembly according to any one of Claims 2 to 7, wherein the sleeve is adapted to resiliently engage the inner surface of a barrel of a power actuated tool.

9. A fastener assembly according to Claim 8, wherein the sleeve includes a plurality of slots extending forwardly from a rear end of the sleeve, said slots being closable at their rear ends to enable resilient contraction in the diametrical size of the rear end of the sleeve.

10. A fastener assembly according to Claim 9, wherein the rear end portion of the sleeve includes radially projecting formations arranged to engage the inner surface of the barrel of the tool.

11. A fastener assembly according to any one of Claims 1 to 10, wherein the sleeve includes diametrically opposed apertures in its circumferential wall whereby the sleeve forms an eyelet.

12. A fastener according to any one of Claims 1 to 11, wherein the sleeve is formed from a sheet metal blank and is shaped by a series of drawing operations which form the column and the body.

13. A fastener sleeve adapted to be attached to a substrate by a pin-like fastener driven by means of a power actuated tool, said sleeve comprising a tubular body having a forward end wall with an integral tubular column projecting rearwardly within the body, said column being arranged to permit passage of a shank of the fastener through the forward end wall and into the substrate but being engagable by a head of the fastener in order to decelerate the head by progressive collapse of the column.

14. A fastener sleeve according to Claim 13, wherein the body of the sleeve includes longitudinal slots extending from the rear end, said slots permitting resilient diametral contraction of the rear end portion of the sleeve to engage the sleeve to be resiliently held within a barrel of the tool.

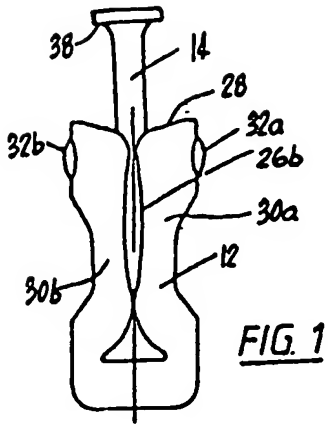


FIG. 1

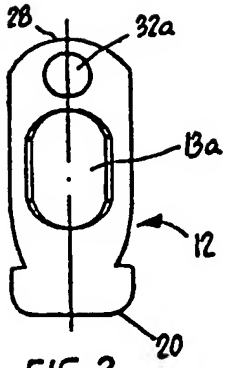


FIG. 2

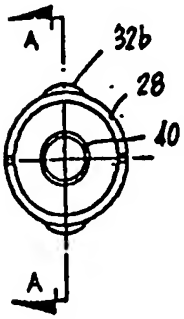


FIG. 3

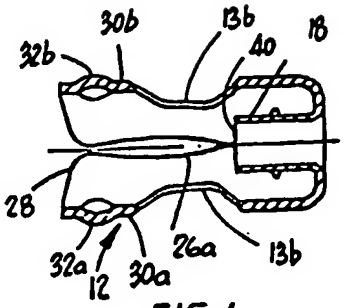


FIG. 4

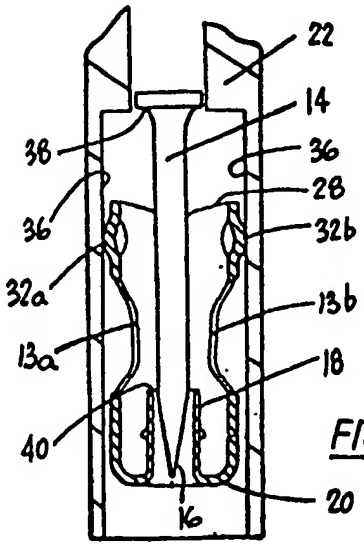


FIG. 5

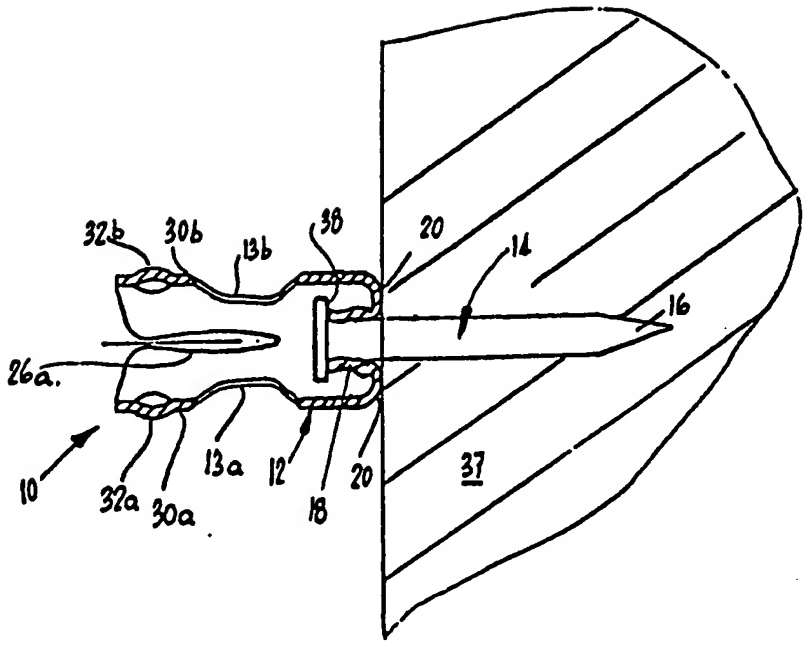


FIG. 6

INTERNATIONAL SEARCH REPORT

International Application No. PCT/AU 90/00229

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) 6

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl.[5] F16B 19/14

II. FIELDS SEARCHED

Minimum Documentation Searched 7

Classification System	Classification Symbols
IPC	F16B 19/14

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched 8

AU: IPC as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT 9

Category*	Citation of Document, 11 with indication, where appropriate, of the relevant passages 12	Relevant to Claim No 13
X	Derwent Abstract Accession no. G8726W/27, Class Q61, DE,A, 1500778 (HILTI AG) 26 June 1975 (26.06.75)	1,2,6,8,13
P,X	Derwent Abstract Accession no. 89-180223/25, Class Q61, EP,A, 321396 (HILTI AG) 21 June 1989 (21.06.89). See drawing and abstract	1,2,6,8,10
X	AU,B, 6730/55 (206826) (PORTABLE INDUSTRIES, INC) 11 August 1955 (11.08.55). See entire document	1-13
X,Y	CH,A, 310181 (BAUER et al) 15 October 1955 (15.10.55). See drawings	1,2,6,8,10
X	US,A, 3841474 (HILTI AG) 15 October 1974 (15.10.74). See line 64 column 1 to line 30 column 2	1,2,6,8,13
Y	GB,A, 1235870 (HILTI AG) 16 June 1971 (16.06.71). See lines 50-75, page 1	1,2,6,8,12
X,Y	DE,A, 1925569 (BAUER) 3 December 1970 (03.12.70). See drawings 1-13	1,2,6,8,9,10,12,13
Y	US,A, 3978759 (USM CORP) 7 September 1976 (07.09.76). See entire document	1,2,6,8,9,12,13

* Special categories of cited documents: 10

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
6 August 1990 (06.08.90)	16 August 1990
International Searching Authority	Signature of Authorized Officer
Australian Patent Office	P WARD

Form PCT/ISA/210 (second sheet) (January 1985)

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON
INTERNATIONAL APPLICATION NO. PCT/AU 90/00229

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report	Patent Family Members		
US 3978759	CA 1040464	DE 2609539	FR 2303190
	JP 51113263	SE 7602520	
EP 321396	DE 3743049	US 4915561	
US 3841474	AT 4673/72	CA 960189	CH 562091
	GB 1356743	DE 2134780	AU 31244/71
	BE 771640	CA 964620	CH 535102
	DE 2042769	GB 1348704	US 3779373
GB 1235870	FR 1591475	DE 1625367	

END OF ANNEX